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Voluntary Choices in Concerted Deals

Mechanics and Attributes of the Menu Approach

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When lenders participate voluntarily in a buyback of debt claims, both the price paid for repurchased claims and the secondary market price of the remaining debt rise — so all creditors realize a net benefit. In contrast, the menu approach to debt reduction allows the debtor to reduce its debt at cheaper prices.

This paper — a product of the Debt and International Finance Division, International Economics Department — is part of a larger effort in PRE to understand the costs and benefits of various mechanisms of debt settlement in the context of the international debt crisis. Copies are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Sheila King-Watson, room S8-025, extension 31047 (33 pages).

When sovereign debt trades at a discount on secondary markets, a market buyback increases the secondary market price. The wealth of private creditors increases because part of the funds used in the repurchase is a transfer payment to them.

This transfer of resources can be mitigated by imposing a capital gains tax on the remaining debt. Diwan and Kletzer show how this can be achieved by including exit and new-money options in a menu of options from which creditors can freely choose. The menu approach imposes an implicit tax on the capital gains on the remaining debt by requiring lenders that do not exit to extend new loans in proportion to the debt they retain.

It is enough to make the buyback price equal to the earlier predeal price. Any new-money call will do the job. In equilibrium, creditors will provide enough new money to stabilize the post-deal price at a level that leaves them indifferent to the exit option. Increasing the new money call increases the cost of the menu as well as the extent of the debt reduction achieved.

The menu approach Diwan and Kletzer describe does not require that particular choices

from the menu be assigned to each lender. Instead, it implements debt reduction through a price system, allowing different creditors to select different portfolios in equilibrium from a common set of options.

With heterogeneous banks, some resources will be transferred when participation in the debt reduction plan is voluntary — and the buyback price will generally need to be higher than the prebuyback price.

Diwan and Kletzer illustrate some of their results by analyzing the recent Mexican debt agreement. They show how to read through the complex financial acrobatics to estimate the net debt reduction. Funds provided by international financial institutions benefited both Mexico and its creditors. Mexico directly retained about 62 percent of these resources and the banks 34 percent.

When creditors are heterogeneous and possess private information about the value of debt reduction, to them, a mechanism is needed to elicit that information. Researchers should analyze how a menu can be combined with an auction of new money or exit instruments to elicit that information.

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1. Introduction

A reduction in the nominal debt burden of a sovereign whose debt trades at a discount on secondary markets leads to a rise in the secondary market price. Dooley (1987) argues that if debt is repurchased by the borrower on the secondary market, then the price that must be paid is the equilibrium price of debt claims after the borrower's indebtedness is reduced. If any lender can choose between selling debt claims back to the debtor and retaining those claims, then his opportunity cost for selling is the secondary market price after the debt reduction. Therefore, when lender participation in a buyback of debt claims is voluntary, both the price paid for repurchased claims and the secondary market price of remaining debt rise, so that all creditors realize a net benefit. The amount received from the sale of debt plus the ex post value of remaining debt exceeds the ex ante value of the original outstanding debt.¹

When a debt buyback is financed using the debtor country's reserves or a concessionary loan or official aid from abroad, there is a transfer of part of the funds used in the repurchase to the private creditors. The transfer from the party providing the resources for the buyback to the private creditors is an undesirable consequence of equilibrium under the simple repurchase program. But this transfer of resources can be mitigated by imposing a capital gains tax on remaining debt. If a tax is levied on the remaining debt, then the opportunity cost to lenders of selling their debt claims is reduced for any given net repurchase. The equilibrium buyback price will be less than the ex post equilibrium secondary market price by the capital gains (specific) tax rate on debt claims remaining after debt reduction. There is a tax rate such that the equilibrium price of repurchased debt is the ex ante secondary market price of the debt. The tax revenue

¹Equivalently, Bulow and Rogoff (1989) show that in a market repurchase that marginal buybacks occur at the average cost of debt service while they only reduce the debt burden by the marginal cost of debt service, which is smaller.

collected will be positive if the debt reduction raises the secondary market price. While explicit taxation of creditors' gains may be politically or legally infeasible, there may be alternative schemes to impose such taxes on the capital gains realized by debt-holders during a buyback.

Recently, attempts have been made to reduce the external debt overhang of some highly indebted countries by negotiating a menu of options from which the creditor will select later. An agreed upon menu is a contract, that may be partly implicit, establishing a future opportunity set for the lenders. An improvement upon the status quo is possible only if some degree of contract enforcement is available. The menu approach requires that lenders can commit to choose from amongst a restricted set of actions ex post. The possible means for enforcing a menu include creditor country legal and political institutions and agreements between creditor nations. By agreeing to the contract, lenders face the possibility that they will be penalized for reneging ex post by refusing to allocate their existing debt claims across a portfolio using the menu options. Agreement to a menu of options ex ante can be voluntary and may be necessary for political or, even, legal reasons. While private creditors restrict their options ex post, they may be able to raise their net worth in negotiations. That is, lenders can increase the value of their loan portfolios ex ante by agreeing to choose from a menu of restricted options ex post.

A menu approach can be used to impose an implicit tax on the capital gains on the remaining debt. Such a tax can be set by requiring lenders to extend new loans in proportion to the debt they retain. In some of the recent menu negotiations, the options have included selling back debt claims and retaining them with a pledge of new money. Because debt trades at a discount, a portion of any new money spent to purchase a new debt of equal face value represents a tax. That is, if a dollar is lent and the secondary price is

sixty cents, then the new debt claim is worth sixty cents and the rest is a tax with the revenue accruing to the debtor. A commitment to provide new loans in proportion to retained debt creates a wedge between the price paid to buyback debt and the secondary price of debt after debt is reduced.

Below, we discuss how concerted arrangements for debt reduction can be devised which eliminate the transfer of debtor or donor resources to private debt holders. The menu approach we describe does not require assignment of particular choices from the menu to each lender. The menu offers a set of prices for different options which implement a decentralized equilibrium ex post. Commitments to accept a menu of options including new loans and debt forgiveness along with repurchases may be enforceable. We assume below that private creditors do not need to accept a menu over the status quo, but that once they do, reneging is costly.

The interaction between debt buybacks and the provision of new funds has lead to confusing statements in the debt literature. For example, Sachs (1989) states that money center banks "gain by having the small banks cash in and accept losses by exit bonds, secondary sales and so on. Since any creditor is made better off if another creditor voluntarily makes a concession to the debtor, the large banks have an added incentive to let the small bank get out at a loss, while the big bank postpones any significant concession." Cline (1989) argues that new money is needed in the Brady type deals "to help finance the interest coming due on the unconverted debt." Both authors ignore the important link between the size of the new money call and the equilibrium price of repurchased debt.

2. The Effect of Pure Market Buybacks

Sovereign borrowers choose to service external debt obligations because it is in their enlightened self-interest to do so. Under sovereign

immunity, creditors do not have recourse to an international court to assure settlement of debts through a direct lien on the country's assets as they would in the case of an insolvent domestic client. The threat of the imposition of sanctions in the event of non-payment or insufficient payment provides sovereigns with the incentive to make debt payments. In addition to denials of future official aid flows, the penalties for default include restrictions on the future trading opportunities on international markets for the debtor. These include the disruption of commodity trade, suspension of trade preferences, and reduced access to international financial markets. Because the repayments made by a sovereign debtor are linked to the expected present value of the social cost of sanctions, they need not be strictly proportional to the total outstanding contractual debt burden. Moreover, as the probability of sanctions being exercised (or being used by creditors as a threat to extract higher net repayments) increases, debtor countries can take actions to reduce the effectiveness of sanctions, for example by underinvesting, or by shifting resources to the non-tradable and to the import competing sectors of the economy.²

In this paper, we summarize the various arguments made by the recent debt literature by assuming that the present value of expected debt service payments is an increasing and concave function of nominal debt burden, that is, we take the value of debt to be a smooth function $f(D)$, where $f(D)$ is the value of the total debt claim, D , and $f''(D) < 0$ for all $D > 0$. The marginal price of debt, $f'(D)$, can be positive or negative, although we will assume it is positive: if the present value curve is first upward, then downward sloping, none of the arguments below is changed.³

To illustrate the costs of market-based buybacks, suppose that the

²See Diwan (forthcoming).

³Similarly, our main arguments hold if the debt value function is not smooth.

initial debt is D_0 and that an amount of funds, $\alpha < D_0$ is made available for a debt buyback. If the options available to creditors are to sell debt or simply hang onto debt, the secondary market price of debt will rise from $p_0 = f(D_0)/D_0$ to $p_1 = f(D_0 - (\alpha/p_1))/[D_0 - (\alpha/p_1)]$, where α/p_1 is the face value of the debt reduced. Because $f(x)$ is concave, p_1 exceeds p_0 for $\alpha > 0$. The ex post value of creditor assets is:

$$p_1(D_0 - \alpha/p_1) + \alpha = p_1 D_0 > p_0 D_0 = f(D_0)$$

The capital gain realized by the creditors retaining claims is:

$$(p_1 - p_0)(D_0 - \alpha/p_1) > 0$$

The percentage gain received by those who sell claims and those who retain them is equal.

When contracts that bind the actions of private creditors are feasible and credible, the conversion of the status quo debt claims to a package of assets that has expected present value at least as great can be negotiated. We assume that enforcement of an agreement by private creditors with their home governments and international financial institutions is possible but that creditors do not need to accept a contract which reduces the present value of their assets. Once an agreement is reached, lenders face penalties if they refuse to perform according to the contract (in the recent Mexico deal for example, creditors that did not participate were effectively made junior; see section 7). If enforcement of a contract is only possible for a subset of the creditors, then a debt reduction menu can still be negotiated involving these creditors alone. However, the non-participants free ride, realizing a net

increase in the value of their portfolios. The participating creditors can still increase the value of their assets despite providing pecuniary external benefits to the non-participants. For simplicity, we assume that the entire stock of outstanding claims is represented in the negotiations.

3. Simple Menus: Relend or Exit

To illustrate the role of a menu of options for creditors to choose amongst, suppose that creditor banks are presented with a simple menu of options represented by the pair (p, n) : for each dollar of claim they hold, banks can choose between exiting at a price of p , and relending n dollars.

Given a menu (p, n) , can we tell how much debt reduction, B , and how much new money, N , will actually be achieved? Somehow surprisingly, the answer is yes. More precisely, when "sufficient" funds are available for debt reduction, competition between banks insures a unique equilibrium. To see that, let D_i stand for debt stocks and p_i for debt prices, $i = (1, 2)$, where period $t=1$ refers to the level of the variables before the debt deal, and $t=2$ after the deal is completed. We have:

$$(1) \quad D_1 = D_0 - B + N$$

$$(2) \quad p_i = f(D_i) / D_i$$

$$(3) \quad n = N / (D_1 - N)$$

Lenders choose between the two option in a manner that maximizes the value of their assets subject to the terms of the menu (p, n) . After the deal is completed, debt prices are expected to be higher at $p_1 > p$. This encourages relending as a bank that relends n dollars, will have its old claim revalued.

However, its new claim n will be only valued at p_1 , implying a capital loss of $(1 - p_1)$. Thus, the opportunity cost for holding a unit of debt back from repurchase at price p is $p_1(1 + n) - n$. This implies that when p_1 exceeds $(p + n) / (1 + n)$, the new money option is preferred to the exit option. Thus, less debt will be sold and more new money offered, resulting in less than expected debt reduction. This leads to an increase in D_1 (using equation 1), and thus to a reduction in p_1 (using equation 2). Since creditors are price takers when they optimize ex post, and because the expected present value of debt function, $f(x)$ is strictly concave, the solution to portfolio value maximization by creditors is unique. In equilibrium, we must then have:

$$(4) \quad p_1 = (p + n) / (1 + n)$$

The system of equation (1) to (4) can be solved for B , N , D_1 and p_1 in terms of any menu (p, n) .

Let us focus on the menus that leave the commercial banks indifferent with the status quo. Those menus are simply characterized by:

$$(5) \quad p = p_0.$$

Equation (5) insures that banks are indifferent between exiting at p and the initial status quo valued at p_0 . In equilibrium, equation (4) insures that they are also indifferent between the initial status quo and the relending option. We show below that as n increases, so does the ex post debt price p_1 . Thus, there is a maximum \bar{n} above which p_1 reaches 1. What is remarkable is that any menu (p_0, n) , with n positive and smaller than \bar{n} , will produce an equilibrium in which all the banks, whether they exit or relend retain a

payoff exactly equal to p_0 . Thus, the menu effectively eliminates any transfer of resources to the creditors that could arise from the debt reduction operation. Moreover, knowledge of the function $f(D)$ is not needed to construct menus that allow for debt reduction with no transfer of resources to creditors.

Equations (4) and (5) insure that the post-deal price, p_1 , will be higher than the ex ante price, p_0 . The result that p_1 exceeds p_0 while the buyback price is p_0 may create some confusion. Why is some debt sold at p_0 when the remaining debt claims rise in value to p_1 ? The choice between the options of selling debt or staying in is voluntary, but there is a tax to staying in. This tax is exactly the difference, $(p_1 - p_0)$, per unit of remaining debt. With a positive tax, the post-tax price must rise if the ex ante value of lenders' assets does not fall. Private creditors are indifferent in equilibrium between selling an additional unit of debt and retaining an extra unit of debt since the net value of a unit of debt held back is equal to the price paid in repurchase.

How does the equilibrium amount of debt reduction vary as the new money call is increased? To answer this question, we must determine how D_1 varies with n . Using equations (1) to (5), we get:

$$(6) \quad f(D_1) / D_1 = (p_0 + n) / (1 + n)$$

For any n , equation (6) can be solved for $D_1(n)$. Differentiating (6) with respect to n and rearranging, we get:

$$(7) \quad \partial D_1 / \partial n = - [D_1 / (1+n)] [(1 - p_1) / (p_1 - f'(D_1))] < 0$$

Thus, as n increases, the equilibrium amount of remaining debt falls. Although a-priori counter-intuitive, this result illustrates well the effect of equilibrium considerations applied to free choice among a menu. As the new money call, n , is increased, the exit option becomes more desirable than the relending option. But in equilibrium, both options must be equally desirable. As a result, it becomes necessary to achieve larger debt reductions in order to boost the ex post debt price p_1 , and thus increase the attractiveness of the relending option.

4. Cost of Debt Reduction

If funds, α , are supplied by a third party seeking to benefit the debtor, then a package that effectively taxes in full the capital gains of lenders assures that a net transfer is not made to the creditors. Lenders can agree to choose between selling debt back to the debtor and holding claims with the obligation to provide new loans⁴. A menu that costs exactly α resources can be designed to ensure that lenders are indifferent between the two options and their status quo payoff if the relationship between the present value of debt and the face value of debt, $f(x)$, is known.

In general, the new loans forthcoming under the relending option can be used by the debtor country either for domestic absorption or for further debt repurchases. If they are used for buybacks, then the debt is reduced by more and the tax rate, n , should be higher since the secondary market price rises further. We extend the analysis here to examine the effect of α and of the share of new loans retained by the country for domestic absorption on the types of menus that can be negotiated.

Suppose now that N is the total of new loans made by the remaining

⁴With no loss of generality, we assume that new and old loans have equivalent terms and that interest payments occur just before the debt agreements. More generally, new money can be interpreted as part rescheduling.

creditors and μ is the part of the new financing, $(N+\alpha)$, that is kept by the debtor country to finance domestic absorption. We assume that the net resource transfer to the country, μ , is a monotone increasing function of $(N+\alpha)$. The amount of new funds used to repurchase debt is $(N+\alpha-\mu)$, so that after the debt reduction program, the remaining debt is given by:

$$(8) \quad D_1 = D_0 - [(\alpha + N - \mu)/p] + N,$$

where p is the price paid in the buyback. To assure that creditors receive no net surplus, we let p equal $p_0 = f(D_0)/D_0$. In equilibrium, we have:

$$(9) \quad N^* + f(D_0) = (\alpha + N^* - \mu) + f(D_1^*).$$

where D_1^* is given by (1) evaluated at N^* . The left hand side of (9) is the value of the creditors assets before the buyback, while the right hand side expresses the value of their assets after the whole operation is completed. In addition to the value of remaining debt $f(D_1^*)$, the creditors receive a net amount $(\alpha + N^* - \mu)$. When α exceeds μ , the private lenders gain, so that, if required, they are willing to pay a positive price for debt reduction. The amount of new money necessary for creditors to retain no net increase in the value of their portfolios is positive. There is a solution, $N^* > 0$, to equation (9) given α whenever a part of α is spent on buybacks. Denote this solution by $N^*(\alpha; \mu)$, and the associated ex post debt level by $D_1^*(\alpha; \mu)$.

The secondary price, p_1 , with $p_1(\alpha, \mu) = f(D_1^*)/D_1^*$, is higher than p_0 whenever N^* exceeds zero. This follows from the concavity of the debt value function, $f(x)$.⁵

⁵Proof: For D_0 larger than zero, $D_0 > f(D_0)$, so that, $-D_0(\alpha-\mu) > Nf(D_0) - D_0(N+\alpha-\mu)$, for $N > 0$. Adding $D_0f(D_0)$ to each side and rearranging terms, we obtain $D_0[f(D_0) - (\alpha-\mu)] > (D_0 + N) f(D_0) - [(\alpha-\mu+N) D_0 f(D_0)] / f(D_0)$

When debt reduction creates no change in the value of creditor's assets, the implicit tax rate imposed on remaining debt is $t = (p_1 - p_0)$. The capital gains realized by remaining debt holders are taxed one hundred percent. The capital gain due to debt reduction is $\gamma = [D_0 - (\alpha - \mu + N)/p_0] (p_1 - p_0)$, and the total tax revenue, which accrues to the debtor, is $\lambda = N(1 - p_1)$. N^* is the solution to $\gamma = \lambda$, which is equivalent to (9). The amount of new money required per unit of old debt held back from repurchase is

$$(10) \quad n^* = N^* / (D_1^* - N^*) = (p_1 - p_0) / (1 - p_1).$$

which is equivalent to equation (4). Since the buyback occurs at the ex ante price p_0 , the exiting creditors also break even.

The effect α on N^* and D_1^* can be calculated using (8) and (9):

$$dN^*/d\alpha = (p_0 - f')(1 - \mu') / [(1 - p_0)f' + (p_0 - f')\mu'], \quad \text{and}$$

$$dD_1^*/d\alpha = - (1 - \mu')(1 - p_0) / [(1 - p_0)f' + (p_0 - f')\mu']$$

where $f' = f'(D_1^*)$ and $\mu' = \mu'(\alpha, N^*)$. When $\mu' < 1$, a rise in α increases both N^* and D^* until $f'(D^*) = p_0$. Further debt reduction beyond this point through increases in α decrease the size of the net resource transfer. As long as the marginal value of debt, $f'(D)$, is below the buyback price, p_0 , remaining debtholders realize an increasing capital gain from further repurchases. Therefore, the compensating concession in new money that can be demanded respecting the constraint that creditors are at least as well off with the

$> [D_0 + N - (\alpha - \mu + N) / p_0] f(D_0)$,
using the definition $p_0 = f(D_0)/D_0$. Using equations (1) and (2), the last inequality becomes $D_0 f(D) > D f(D_0)$, implying that $p_1 > p_0$.

program as the status quo rises with debt reduction. However, when debt is reduced far enough so that $f'(D) > p_0$, the implicit tax needed to assure that creditors are indifferent between selling and holding debt declines with further reductions in the debt.

Thus, until debt is reduced to the point that the marginal secondary value of debt, $f'(D)$, equals the buyback price, p_0 , the debtor gains both net resource transfers and debt reduction from further buybacks. If the objectives of the donor place weight only on the debtor's benefits (excluding any other objectives, such as the cost of funds), then the optimal amount of remaining debt for the donor is less than or equal to the solution to $f'(D) = p_0$.

Figure 1 depicts the $f(D)$ curve and initial value of debt p_0 in the top panel. The relationship between N and the ex post debt level D^* is portrayed in the lower panel for solutions to equations (8) and (9). The maximum amount of new money contributed by creditors is attained when $f'(D) = p_0$. Figure 2 illustrates the relationship between N^* and the amount of gift financing α . N^* rises as α increases until the marginal value of debt $f'(D)$ equals p_0 , and then declines towards zero. D is zero when the gift is large enough to buyback the entire debt D_0 at price p_0 , that is, $(\alpha - \mu)/p_0 = D_0$.

If the proportion of available funds used to repurchase debt can change, then an increase in $\mu(\alpha + N)$ for every value of $(\alpha + N)$ acts as a decrease in α . For simplicity, we analyze here the multiplicative case only. Suppose that $\mu(\alpha + N) = \mu \cdot (\alpha + N)$. It is then possible to show that:

$$dN^*/d\mu = (f' - p_0) (\alpha + N) / [p_0(\mu - f') + (1 - \mu)f']$$

$$dD^*/d\mu = (1 - p_0) (\alpha + N) / [p_0(\mu - f') + (1 - \mu)f']$$

The denominator is always positive for all $\mu \in [0,1]$. Thus, D^* increases with

μ . Moreover, N^* increases in μ as long as $f' > p_0$.

These results partially extend to the case where the funds α are a loan rather than a gift. When debt is repurchased with a loan from official sources, seniority considerations also matter. When all debt, regardless of the creditor, has equal priority in repayment, the results developed above go through. The only difference is that when part of the initial transfer is a loan, less new money is forthcoming than in the pure gift case because the new loans reduce the ex post debt price. Consequently, less debt reduction can be achieved for a given transfer. However, when the initial transfer takes the form of senior debt, it impairs the value of existing debt claims since junior debt is now serviced only after the senior loan is repaid. In that case, and in spite of the gains that are due to debt reduction, the value of private creditors' assets is reduced (see the appendix for a treatment of α as junior and senior debt).

In reality, it is probable that IFIs loans are senior to commercial loans, but that they also create efficiency gains due to conditionality (i.e., they lead to an upward shift in the $f(D)$ curve). The net effect of those loans on the payoffs of commercial creditors can then be positive. The menu approach can help ensure that those net benefits are taxed so that the debtor country can retain a larger share of the efficiency gains due to conditionality.

5. Underfunded Menus

When private creditors commit ex ante to choose between selling back debt and holding onto debt claims with an obligation to make new loans, an equilibrium debt reduction program that leaves commercial banks at their status quo payoff levels does not require that the ex post choice of each creditor from the menu be negotiated and specified or even that aggregate constraints be placed on the total amounts of debt reduction and new money. Prices, that is, the offer of p_0 for debt bought back and any ratio of new

loans to remaining debt claims required, n (with $n < \tilde{n}$), are sufficient.

On the other hand, given available resources α , it is possible to pick an n that will lead in equilibrium to an allocation that costs exactly α : that is, for any amount of resources, α , and buyback price p_0 in the simple model, there is a solution for n . With a competitive equilibrium in the debt market, the outcome that can be computed given the function $f(D)$ and the prices p_0 and n is attainable.

Selecting the appropriate value of n to assure that the defined amount of debt reduction is achieved in equilibrium requires knowledge of the debt value function, $f(D)$. If there is uncertainty about $f(D)$, then setting n leads to a random amount of debt reduction (and consequent demand for buybacks). Given p_0 and n , there still need be no windfall gain to creditors, but the amount of resources required of the donor or lender is uncertain. If n turns out to be too low, only a portion of α will be used, but creditors will remain at their status quo payoff level. However, if n turns out to be too large, α will not be sufficient to buyback all the tendered debt. The possible responses in that case are to increase α , to lower n in a second round offer, or to ration buybacks using some reallocation mechanism.

In the latter case, creditors will suffer a loss compared to their status quo payoffs. As a result, they will have to be compensated ex ante for this eventuality with a higher p and/or a lower n . To see that, suppose that a menu (p, n) is offered, but that it is known in advance by all the participants that the country is only prepared to spend a smaller amount $\beta < \alpha$. In that case, an equilibrium will not exist. Instead, all banks will prefer to exit rather than to relend. Remember that for an equilibrium to exist, sufficient funds are needed for buybacks so that the ex post debt price p_1 is driven up to the point where relending is as desirable as exit. When the funds available to support the equilibrium are insufficient, p_1 does not rise

sufficiently and relending at price n is not as desirable as exit; equation (4) will hold then as an inequality.

With insufficient funds, a distribution mechanism is needed to allocate the scarce buyback resources. For example, buybacks can be distributed on a pro-rata basis. If all banks are similar, they all end up with a similar mix of cash and new loans, per unit of old debt. Given n , what is the lowest exit price that the debtor can now offer in order to keep the banks at their initial status quo payoff level? The final allocation must produce a value equal to p_0 , per unit of old debt. Since relending is not as desirable as exiting, the exit price, p , must now be larger than p_0 in order to produce a mix with a value of p_0 .

However, there are two major reasons why an underfunded deal is not in the interest of the debtor country. First, it makes it more difficult for the debtor to capture all of the creditors surplus. In effect, it is necessary to estimate correctly the ex post price p_1 in order to build relending/exit mixes that have value p_0 . On the other hand, a program that is adequately funded preserves the status quo as long as p is set equal to p_0 , even when $f(D)$ is not known. The only disadvantage of not knowing exactly $f(D)$ is to render the cost of the program is uncertain.

Second, adequately funded menus allow the debtor to discriminate better between different types of creditor banks. But as discussed in the next section, banks are in reality heterogeneous. Because equilibrium deals allow banks to choose themselves from the menu the options that they value most while ad-hoc distribution mechanisms do not, they allow the debtor to reap efficiency gains.

6. Heterogeneous Banks

In the analysis above, we assumed that each creditor bank valuation of country debt depends on aggregate debt outstanding only, but that it is

independent of the quantity of debt held in its own portfolio. This implicitly assumes that the standard capital asset equilibrium model applies: that is, the secondary debt market is competitive and efficient, banks are risk averse institutions, country debt is spanned by the universe of existing assets, and regulatory considerations do not influence debt valuation. In equilibrium, the demand for LDC debt is infinitely elastic as the marginal and average valuations of debt claims are equalized across all banks.

However, commercial banks' relative valuation of the exit and relending options may differ due to differences in expectations, in characteristics of their balance sheets, and in the regulatory, tax and accounting systems within which they operate. But with a competitive and efficient secondary debt market, and when country debt is spanned by the universe of existing securities, differences in expectations alone cannot explain the existence of a surplus over the secondary market price since those differences can be intermediated through the secondary market.⁶

However, differences in regulatory treatment of debt results in valuations that are different despite the existence of a competitive market. Due to mispriced deposit insurance, banks gain by increasing leverage as much as possible (see Merton [1977], Sharpe [1978], Kane [1985]). While leverage is limited by capital adequacy requirements, book value application of those requirement create extra value for claims whose real value has fallen below book value. In effect, claims that are entered on the books at a premium over their real value allow banks to over-represent their own capital. As a result, banks holding such claims can increase their effective leverage above the allowed book leverage. Therefore, banks that sell inherited debt that is

⁶In contrast, with incomplete markets, the banks' demand function slopes down. Differences among banks imply that their own valuation of debt held is not the same in equilibrium. In such a case, choices over a menu of options can differ, despite the fact that the marginal valuations of all banks are equal.

treated at par by regulators lose valuable rights to excess leverage. Since the FDIC insurance subsidy (and thus excess leverage) is more valuable to weak institutions, the loss incurred by selling debt at a discount is proportional to the selling bank's financial strength. Thus, choice over a menu will differ, with relatively stronger banks exiting, and relatively weaker banks relending (see Demirguc-Kunt and Diwan [1990] for such a model).

Note that the market does not intermediate these differences in valuation away. The market price is simply the price at which the strongest bank is willing to exit. The weaker banks however would lose if they exited at that price. In such a framework, it can be shown that a single buyback price has to be high enough to convince the marginal bank to exit. Stronger banks also exit and gain. Weaker banks relend and gain. As a result, a menu cannot extract all of the creditors' surplus (see Diwan and Spiegle for an analysis).

Heterogeneous creditors are likely to possess private information about their marginal valuation of debt. An auction can serve to reveal this information so that the single buyback price and single linear new money tax may not be equivalent to other methods of implementation in the presence of asymmetric information. Different implementation mechanisms can achieve different results in taxing creditors' rents differentially, and supply constraints can result in efficiency losses. Also, more gains can be achieved by extending the menu. For example then banks may have different preferences over the timing of uncertain payments. In this case, more instruments are needed for the new money options. Similarly, when tax considerations and bank regulation impose different costs on banks that depend on the timing of the realization of losses, different exit options are needed. Those extensions are left for subsequent work.

7. Evaluation of the Mexico 1990 deal

We now apply the above analysis to the case of the recent Mexican debt

agreement. First, we describe the deal. Second, we verify whether the actual bank choices resulted in an equilibrium as predicted by equation (4). We then discuss whether Mexico could have achieved a better deal. We note at the outset that our computations below are illustrative. They indicate orders of magnitude rather than exact values as second order effect are often ignored.

The Deal

Mexico and the steering committee of its creditor banks negotiated for approximately 4 months. On July 23, an agreement was reached on a package that covers about \$48.9 billion in medium-term and long-term debt. It offers commercial banks a menu of three options:

1. a discount bond: a 30 year bond with a discounted principal of 65% of the face value of existing debt and an interest rate of LIBOR plus 13/16;
2. a par bond: a bond with no discount but a low interest rate of 6.25% fixed for the lifetime of the bond; and
3. a new money package: 25 percent of exposure (7% of principal balance at the conclusion of the agreement and 6% in 1990, 1991 and 1992), at an interest rate of LIBOR plus 13/16.⁷

The principal of both bonds is guaranteed through collateralization of a 30-year zero-coupon bond (US-Treasury or its equivalent in case of other currencies) and 18 months of interest payment are guaranteed on a rolling basis through an escrow account. In addition, both bonds include a recapture clause which stipulates that, in case the oil-price increased by a certain percentage in the years 1997 and beyond, that the creditors would share in the increased revenue stream. The agreement also contained a financing facility contingent on oil prices.⁸

⁷Note that the present value of the new money call is approximatively given by $[\frac{.07}{1.1} + (\frac{.06}{1.1}) + (\frac{.06}{1.1})^2 + (\frac{.06}{1.1})^3] = .21$.

⁸The agreement further specified a certain number of relending options, in which banks would be allowed to relend, up to a certain maximum fraction, their claims to Mexican public companies. In addition, banks participating in

In total an amount of \$7 billion have been used for debt and debt service reduction, of which \$5.757 billion were available from new loans from the World Bank, IMF, and Japan, and \$1.243 billion from Mexico's own reserves.

The choices made by banks in early March were the following: 46.7 percent of the debt was swapped into the par bond; 40.2 was swapped into the discount bond; and 13.1 percent contributed new money. Total new money amounted to \$1.602 billion. Since Mexico provided \$1.243 billion to finance the debt exchange, it was able to secure on a net basis \$360 million of new liquidity.⁹ In terms of our model, we have: $\alpha = 5.757$ billion; $\mu = .36$.

Evaluation

The agreement effectively dealt with free riding incentives in the sense that non-exiting banks have to contribute with new money. An important part of the agreement was the explicit rewriting of the existing debt contracts so that the previous agreements, both between the debtor and the creditors and among creditors, are not longer binding. The major implication of this so called "novation" is that debt which is exchanged into the new instruments (including some of the new money provided) would no longer be subject to the sharing clauses. This drastically reduced the problem of free-riders since they are not able to share equally in payments made by Mexico on its restructured debt. For instance, in case Mexico would pay in full on the new instruments, but would not pay in full on debt which was not exchanged, the holders of the non-exchanged debt would not be able to share in the payments the holders of the new instruments receive. The "novation" clause gave claim holders a greater incentive to accept one of the three options.

the debt relief are eligible to participate in a debt-for-equity swap program of at most \$1 billion per year. The program would involve public sector companies being privatized and qualified infrastructure projects.

⁹For additional details on the agreement, see Lamdany (1989) and especially, van Wijnbergen (1990).

However, one problem with the way in which the deal was structured is that the relative prices of the three options were predetermined and no single price was allowed to be determined in a competitive fashion.¹⁰ In our model, n is unique (in equilibrium) given p_0 and α . Fixing n in the agreement is acceptable if correctly chosen. However, if an incorrect n is chosen, α needs to be adjusted ex post. It seems that due to the difficulty of estimating the $f(D)$ curve, n was fixed too high given the available resources. As a result, additional financing had to be sought in order to complete the deal.

Analysis

Instead of being bought back as assumed in the model, old debt was exchanged for new bonds, a mix of pure Mexican debt claims and riskless collateral. In order to analyze the deal, we need first undo the complex financial arrangement. As the deal eliminated one class of debt claims and created several new ones, we must carefully define our unit of pure Mexican risk. In the sequel, we define debt prices as the price of an unsecured 30 years bond with a coupon rate of LIBOR+13/16.¹¹ As in our model, we denote by p the buyback price, and by p_1 , the ex post debt price.

To compute the implicit price of pure Mexican debt, we use market information on the discount bond.¹² Each discount bond is a mixture of pure Mexican risk valued at p_1 , and collateral, c .¹³ For a \$100 loan, it can be calculated that the value of the collateral is about $c = \$24.278$ (7.785 for the principal, 12.29 for the 18 month interest, and \$2 for the recapture value¹⁴). Stripping the 18 month interest payments and the principal, we are

¹⁰The main reason being that US regulators may have obliged banks to set reserves according to their bid price rather than to their accepted price.

¹¹This can be compared with the pre-deal secondary market debt prices which were computed in a very similar fashion.

¹² Using the price of the par bond to extract the needed information is more problematic due to the fact that it offers a fix interest rate.

¹³For a discussion of equivalences between buybacks and debt exchanges, see Lamdany and Underwood (1989) and Claessens and Diwan (1990).

¹⁴See The value of the recapture clause is calculated by Claessens and van

left with less than our yardstick of Mexican risk, more precisely, with about .788 of a standard pure Mexican loan.

The post-deal price of pure Mexican risk, p_1 , can now be calculated using the technique outlined above. After the completion of the deal, the discount bond price stabilized at 65 cents, implying that $p_1 = 52 [(65 - 24.28)/.788]$.

The implicit buyback price p can also be approximated from the trading price of the discount bond. Since a unit of old debt was exchanged for .65 units of the exit bond, old debtholders were given a value of 42 cents $(.65 \times .65)$.¹⁵

What was the status quo price before the deal was achieved? Using an estimate of the debt value curve $f(D)$, and given that at the time of the agreement, Mexico had \$107 billion of medium and long term debt outstanding and its export were estimated at \$28 billion, we can predict that the equilibrium secondary market value for Mexican debt of 38 cents (see appendix 2). This is in line with the observed market prices before the announcement of the deal. Prices in the secondary market were in fact quite volatile in the period leading to the Brady speech and the beginning of the Mexican debt negotiation, fluctuating between 35 cents and 40 cents. Thus, the price jump to $p_1 = .52$, in the order of 37 percent was remarkably large.

Did the creditors anticipate this price jump? Evidence can be gathered using the equilibrium condition in (4). Given that banks were free to choose between the options that were offered, if the banks correctly anticipated the amount of debt reduction, the ex post price p_1 should have obeyed the equation $p_1 = (p + n) / (1 + n) = (.42 + .21) / (1.21) = .52$ (see footnote 6). Somewhat surprisingly, the answer thus seems to be that the market reacted in an

Wijnbergen (1989,

¹⁵ Using a different technique, Lamdany (1990) finds a similar value.

extremely rational fashion.

We can now compute the implied amounts of debt reduction and new money achieved in the deal. This is not an easy matter because the exit and discount bonds are a mixture of buybacks and relending (since the collateral has been spent, the collateralized portion corresponds to an implicit buyback). But we can use shortcuts. The remaining nominal debt claims (in terms of old debt) are given by equation (12): $D_1 = 48.9 - (5.397 + N)/.42 + N$. From equation (14), $n = N/(D_1 - N) = .21$. We can solve those two equations to get: $D_1 = \$29.066$ billion and $N = \$5.057$ billion.

Let us check the consistency of our estimates. The menu must have ensured that all creditors retained a value of $p = .42$ per unit of old debt, irrespective of whether they exited or relent. The capital gain of the creditors that stayed in that was due to debt reduction is $\gamma = (D_1 - N)(p_1 - p) = (29 - 5)(.52 - .42) = \2.4 billion. On the other hand, the tax revenue to Mexico from the new loans those creditors had make to is given by: $\lambda = N(1 - p_1) = 5(1 - .52) = \2.4 billion. So indeed, they just broke even and got as much as those that exited, i.e 42 cents on the dollar.

We can compute now the characteristics of the deal: \$24.89 billion of old nominal debt claims were bought back $(5.397 + 5.057)/.42$, leading to a net debt reduction of (old nominal) commercial debt claim of \$19.8 billion $(24.89 - 5.057)$.

Before the deal, the market value of Mexico treatable debt was about \$18.6 billion $[48.9 * .38]$. After the deal was completed, the value of its remaining commercial debt evaluated at the new (and higher) debt price was about \$15.114 billion $[29.006 * .52]$. The value of its debt was thus reduced by \$3.468 billion. Mexico also retained \$.36 billion in liquidity, for a total value of \$3.83. Compare that with the IFIs contribution of \$ 5.8 billion.

\$1.95 billion have disappeared! This is in fact the banks gain over their status quo payoffs.

A deal that would have left the banks at their status quo payoff level should have set p_0 at about 38 cents. Therefore, the implicit buyback price of 42 cents increased the payoff of the banks by about 4 cents $[\.42 - .38]$ per unit of old debt, for a total of about \$1.95 billion $[48.9 * .04]$. Thus, of the 5.78 billion contributed by the IFIs, Mexico retained 3.5 billion (or 66 percent), and the banks \$1.9 billion (34 percent).

Finally, we check that our technique that reduce the deal into its basic components is relevant. Under our interpretation, each new bond offered is part exit and part new money. Consider the discount bond for example. One dollar of old debt was swapped for .65 discount bond. Since there is \$.243 of collateral in each discount bond, a dollar of old debt received \$.157 in quasi-cash $(.65 * .243)$. It also received a claim worth \$.512 in old debt units $(.65 * .788)$. Is this mix consistent with the menu $(p = .42, n = .21)$?

From the \$.512 of debt received by each old claim, .089 must have been the required new loan, and \$.423 the old debt (check that $.423 * 1.21 = .512$). Since the old debt retained is \$.423, \$.576 of old debt must have been bought back for an amount of \$.242 $(.577 * .42)$. Therefore, an holder of an old unit of debt received \$.242 for the buyback portion of the deal, and he contributed \$.089 for the new money portion. Thus on net, he received \$.153. This is indeed very close to the quasi-cash received of \$.157 computed above.

8. Concluding Remarks

When sovereign debt trades at a discount on secondary markets, a market buyback leads to an increase in the secondary market price. The wealth of private creditors increases because part of the funds used in the buyback is a transfer payment to them. When banks are homogeneous banks, we show how

the inclusion of an exit option and a new money option in a menu of options from which the private creditors freely choose can eliminate the wealth transfers due to the debt reduction. It is sufficient to set the buyback price equal to the ex ante status quo price. Any new money call will do the job. In equilibrium, creditors will provide enough new money to stabilize the ex post debt price at a level that leave them indifferent to the exit option. The important effect of increasing the new money call is to reduce the cost of the menu and the extent of debt reduction achieved.

The menu approach we describe does not require assignments of particular choice form the menu to each lenders. Rather, it implements debt reduction through a price system, allowing different creditors to select different portfolio in equilibrium from a common set of options. However, with heterogeneous banks, some transfer of resources will occur when participation in the debt reduction plan is voluntary and the buyback price will generally need to be above the pre-buyback price.

To illustrate some of our results, we analyze the recent Mexican debt agreement. We show how to read through the complex financial acrobatics to estimate the extent of net debt reduction achieved. We show that the funds provided by IFIs benefited both Mexico and its creditors. Mexico retained about 62 percent of that transfer, and the banks 34 percent.

When creditors are heterogeneous and possess private information about the value of debt reduction to them, a mechanism is needed to elicit that information. Important topics for future research include analyses of how a menu can be combined with an auction over new money or exit instruments to induce revelation, and of the efficiency of various possible implementation mechanisms in the presence of market distortions and with heterogeneous creditors.

Appendix 1

The case with Multilateral Loans

Consider the possibility that debt is repurchased with a loan from official sources with an interest in providing debt reduction and new liquidity. We first consider the case in which all debt, regardless of the creditor, has equal priority in repayment. That is, a government or IFI does not possess legal seniority privileges vis-a-vis private creditors; this institutional assumption is ad hoc. For simplicity, we only analyze the special case that the entire new money tax is used for domestic absorption.

A loan can be made by the third party in several ways, one of which is equivalent to the provision of private new money. The loan amount, L , can be provided in exchange for a debt obligation of face value, L . Therefore, the expected present value of the acquired debt is less than L , and the agency is part donor. Another extreme is that the nominal debt obligation exceeds L by the discount on debt, so that the expected present value of the new debt obligation is equal to the amount paid, L . In the absence of seniority differences between the agency and private creditors, additional debt bought at the secondary market discount using the latter type of loan can never achieve debt reductions if private creditors are not forced to accept losses. This is easily seen by noting that the reduction in private debt is made up one for one with new debt. Any new money tax imposed on private creditors results in an ex ante appropriation of their wealth.

New money in the form of the former "donor" loan can yield both debt reduction and more private loans. Suppose that the new loans ($L+N$) are entirely used to buyback debt, with L being a new debt obligation for the borrower. Private creditors are indifferent between the status quo and equilibrium debt reduction under the menu if the following equation holds:

$$f(D_0) + N^* = p_1 [D_1^* - L] + L + N^* \quad (A1)$$

$$\text{with } D_1^* = D_0 + N^* + L - (L + N^*)/p \quad (A2)$$

and where $p_1 = f(D_1^*)/D_1^*$. The right hand side of (A1) is the value of the assets held by all private creditors ex post. It also expresses the point that the ex ante price of debt, $f(D_1^*)/D_1^*$, equals the ex post price minus the tax imposed through new loan commitments. Setting the buyback price equal to $p_0 = f(D_0)/D_0$, there is a positive solution N^* to equation (A1) for concave functions, $f(x)$. Creditors will be indifferent between selling debt claims at the ex ante price and holding them with the commitment to provide a proportionate share of the equilibrium new money.

The effect of an increase in L on the extent of debt reduction and net resource transfer to the debtor is easily calculated using (A1) and (A2):

$$\partial N^*/\partial L = [p_0 (1 - p_1) / (1 - p_0) \Pi] - 1$$

$$\text{and } \partial D_1^*/\partial L = - (1 - p_1) / \Pi < 0$$

$$\text{where } \Pi = (1 - L/D_1^*)f'(D_1^*) + (L/D_1^*)p_1$$

Comparison with the gift case in section 4 reveals that when part of the initial transfer is a loan, less new money is forthcoming than in the pure

gift case because the new loans reduce the ex-post debt price. Consequently, less debt reduction can be achieved for a given transfer.

Senior Loans by the IFIs

Without presuming that IFI debt is senior to private debt, we explore the effect that such seniority privileges would have if they exist. Suppose that a new IFI loan is senior to private debt. Let L be the amount of new funds provided by the IFI, and assume that the face value of the debt purchased equals L . In this case, the IFI loan impairs the value of existing debt claims. After a senior IFI loan, L , is made, the value of private debt becomes $[f(D+L) - f(L)]$ which equals the present value of debt claims, D , when they are only serviced after the loan of size L is repaid.

Suppose that L is used to repurchase debt, and that no new money is required. That is, commitment by private lenders is not assumed, so that they just hold out for the ex post price. The buyback price, p_1 is given by:

$$p_1 = [f(D + L - B) - f(L)] / (D - B). \quad (A3)$$

The amount of the loan used for buybacks is $p_1 B$. Suppose that all of L is used for buybacks, then in equilibrium, B solves the following equilibrium condition

$$L/B = [f(D + L - B) - f(L)] / (D - B), \quad (A4)$$

yielding the solution p_1^* . Since $f(x)$ is concave, this has a solution for $L < B$, if $0 < L < D$.

Figure 3a depicts an equilibrium price when a buyback is financed by a senior IFI loan. The amount of the loan used to repurchased B units of debt is shown on the right hand side of the figure as $p_1 B$. For the values of p_1 and B shown, the demand for buybacks does not use up all of the loan L . When all of L is used to repurchase debt, the equilibrium values of B and p_1 are larger, so that $p_1 B$ equals L . Figure 3b shows the effect of dilution: p_0 is the price of private debt before the senior loan is made and p_1^* is the ex post equilibrium price.

Comparison of the ex post equilibrium price paid in a buyback to the ex ante price (before the senior loan is made) shows that the value of private creditors' assets is reduced and the present value of all expected debt repayments $f(D + L - B)$, falls. Letting L/B equal the ex post price, p , equation (A4) implies the solution for p :

$$p = [f(D + L - L/p) - f(L)] / (D - L/p) \quad (A5)$$

Note that as pD approaches L (all private debt is repurchased), the right hand side remains less than unity, in contrast to the case of equal seniority. Therefore, a solution to equation (A5) exists for p and L such that all the private debt is repurchased and the ex post debt burden, L , is smaller than D . This reduction in the expected present value of debt repayments is financed by the dilution of the private creditors' debt claims caused by the senior loan. The difference, $f(D) - f(L)$, is the net transfer from private creditors to the debtor; this is a transfer of future rather than current resources.

To further illustrate the dilution effect of an increase in senior

debt, suppose that private creditors are offered the ex ante secondary market price, p_0 in the buyback (say for political reasons). From equation A5, if the repurchase price is set to $p_0 = f(D)/D_0$ on the right hand side, then the solution for the export secondary market price of private debt (appearing on the left hand side) is less than p_0 for a senior IFI loan, L less than $f(D_0)$. Remaining private creditors suffer a capital loss and prefer to sell back debt. An equilibrium buyback price such that creditors are indifferent at the margin between selling and retaining debt is lower than the initial price p_0 .

Appendix 2

The Debt Value Curve and the Debt Reduction/New Money Frontier

Conceptual models as well as empirical observations support the view that--holding everything else constant--the market value of debt will fall short of its face value at an increasing rate as indebtedness increases. This is reflected in the decrease in the unit price of debt as indebtedness increases. Several empirical studies have measured this relationship by estimating price equations (Claessens (1988), Purcell and Orlanski (1988), Sachs and Huizinga (1988), and Vatnick (1988)). Some of these papers use regressions of the log of price on the log of debt ratio and other conditioning variables.

We prefer to use here a logistic form which does not force the elasticity to be the same at all levels of D (see Cohen [1989] and Claessens, Diwan, Froot and Krugman [1990]). The resulting price equation (estimated using a cross-section of 35 countries) is given by:

$$\ln [p / (1 - p)] = 7.88 - 1.41 \ln(D/X)$$

where D/X stands for the debt to exports ratio.

At the time of the agreement, Mexico had \$107 billion of medium and long term debt outstanding and its export were estimated at \$28 billion. Plugging these values into the equation above predicts a secondary market value for Mexican debt of 38 cents. This is in line with the observed market prices before the announcement of the deal which fluctuated between 35 cents and 40 cents.

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